Wiring The World

Dave (and Alethea) Price
Computer Science
Aberystwyth University

(Updated 22nd February 2016)

Overview

- History of the World Telephone Network
- History of the Computer
- History of the Internet
- The Internet versus its Applications
- Some new Applications
- Implications for the way we live, work and play
- The Internet – a basis for distributed, multi-tier application deployment

Global Telephone Network

- Telegraph Demonstration - 1804
- Telegraph in use - 1839
- First Transatlantic Telegraph Cable - 1868 (but only two words per minute !)
- Bell Telephone demo - 1876
- Strowger Telephone Exchange - 1888
- First Transatlantic Telephone Cable - 1956
- First Digital Exchange - 1968
- First ISDN specifications - 1984

Sam Hallas's Web Site

- History of Telegraphy
- History of Telephony
- BT Museum Memorial Web Site
- Lots of Nice pictures - used by permission
  - http://www.samhallas.co.uk/

Hughes Printing Telegraph

David Edward Hughes, born between Corwen and Bala about 1831. Hughes conducted successful wireless transmission experiments in Great Portland Street London, before Marconi.

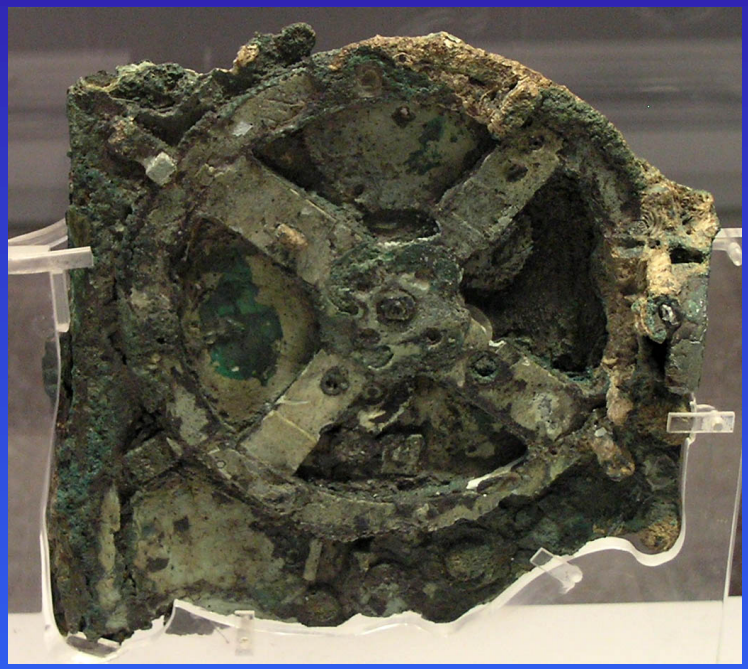
http://en.wikipedia.org/wiki/David_Edward_Hughes

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
GENERAL POST OFFICE

POST-OFFICE TELEGRAPH'S
GOWER-BELL
LOUD-SPEAKING TELEPHONE

Computer History - **Antikythera mechanism**

- Estimated to have been made around 100 BC
- This device is not believed to have been "programmable".
- It is capable of a very complex set of interrelated computations.



"This machine has the oldest known complex gear mechanism and is sometimes called the first known analog computer, although the quality of its manufacture suggests that it may have had a number of undiscovered predecessors during the Hellenistic Period."

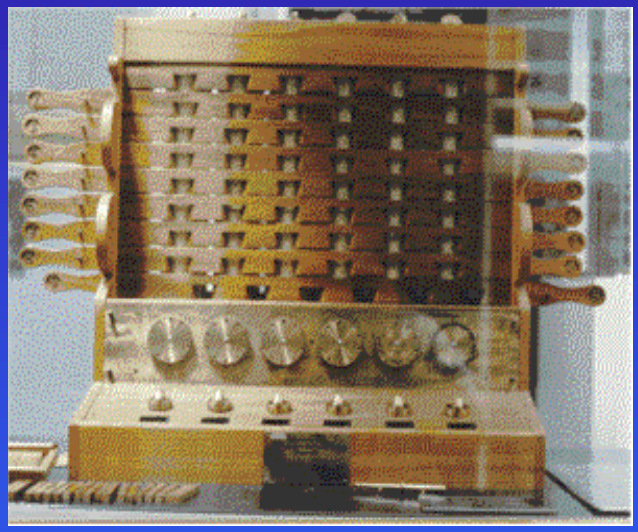
http://en.wikipedia.org/wiki/Antikythera_mechanism

Computer History - **Antikythera mechanism**

- **Antikythera Research Project**
  - http://www.antikythera-mechanism.gr/
- **Probing the secrets of the Antikythera Mechanism**
  - http://www.bbc.co.uk/news/science-environment-17989915
- **Ancient Moon 'computer' revisited**
  - http://news.bbc.co.uk/1/hi/sci/tech/6191462.stm
- **Divine mechanics in a garden shed**
  - http://www.bbc.co.uk/news/uk-england-london-18448518
- **Various Antikythera videos on Youtube**
  - http://www.youtube.com/user/antikythera2012

Computer History (2)

- Wilhelm Shickard's
  - Calculating Clock – 1623



- Five Digit adder - 1644
- Babbage Difference Engine - 1812
- Ada Lovelace write programs - mid 18xx
- Harvard ASCC M-1 - 1944
  - Automatic Sequence Controlled Calculator
- Alan Turing / Tommy Flowers "Colossus" - 1943
- ENIAC - 1945/6
  - Electronic Numerical Integrator and Computer
- Manchester SSEM - 1948 (first stored program computer)

Computer History (3)

- Grace Hopper invents Compiler - 1951
- MainFrames developed - 1950s, 1960s
- MiniComputers - 1970s, 1980s
- Altair Microcomputer - 1975
- Home Computers - 1977
- Spreadsheets (VisiCalc) - 1979
- IBM PC - 1981

Internet History

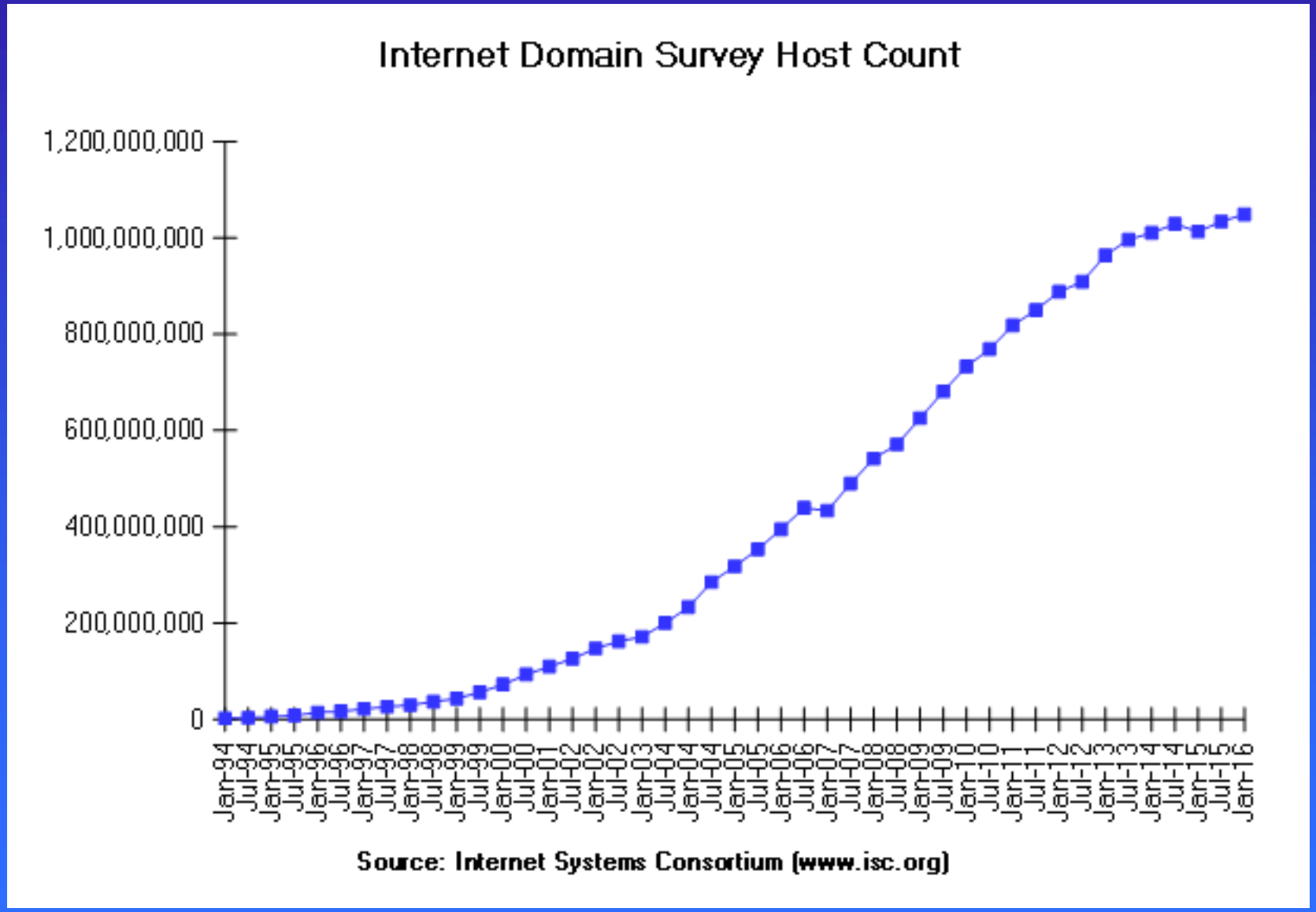
- First created during the "Cold War" in September 1969
- Initially University and Government Research Laboratories in the USA
- Decentralised Computer Network - main design aim - no single point of failure

Internet Evolution

- Now Global
- Network of Networks
- No single organisation controls the Internet
- Co-operative Anarchy
- Like a "global electronic road network"
- Transition of all Internet connected devices to the current mode of operation of the Internet occurred during 1982 and the final change over happened on January 1st 1983

Internet Size

- Now the biggest computer network by far
- More trans-Atlantic Internet traffic than voice telephony
- Reaches almost every country in the world
- growth rate, approximately 10% per month, until 1994 and since its exploded…
- at end of 1995, about 7,000,000 connected hosts (computers and other devices)
- by July 2001, about 125,888,197 connected computers
- by Jan 2002, about 147,344,723 connected computers
- by July 2002, about 162,128,493 connected computers
- According to Nua Internet Surveys 605.60 million million people were “on-line” in Sept 2002



"Source: Internet Systems Consortium (http://www.isc.org/)"

Internet Applications

- Supports many different Applications
- Early applications were for file transfer, electronic mail and access to distant shared computers
- Electronic News groups appeared
- More recent applications provide shared access to inter-linked multimedia databases and the ability to transport voice, video etc.
- Now lots of multi-tier, distributed applications appearing

World Wide Web

- Probably the most important application so far invented [– now being used as a vehicle to deliver other applications/services]
- Invented by a Briton, Tim Berners-Lee who was working at CERN in Geneva (now Sir – knighted)
- "Interlinked multimedia globally distributed document store"
- Users gain access via a "browser"

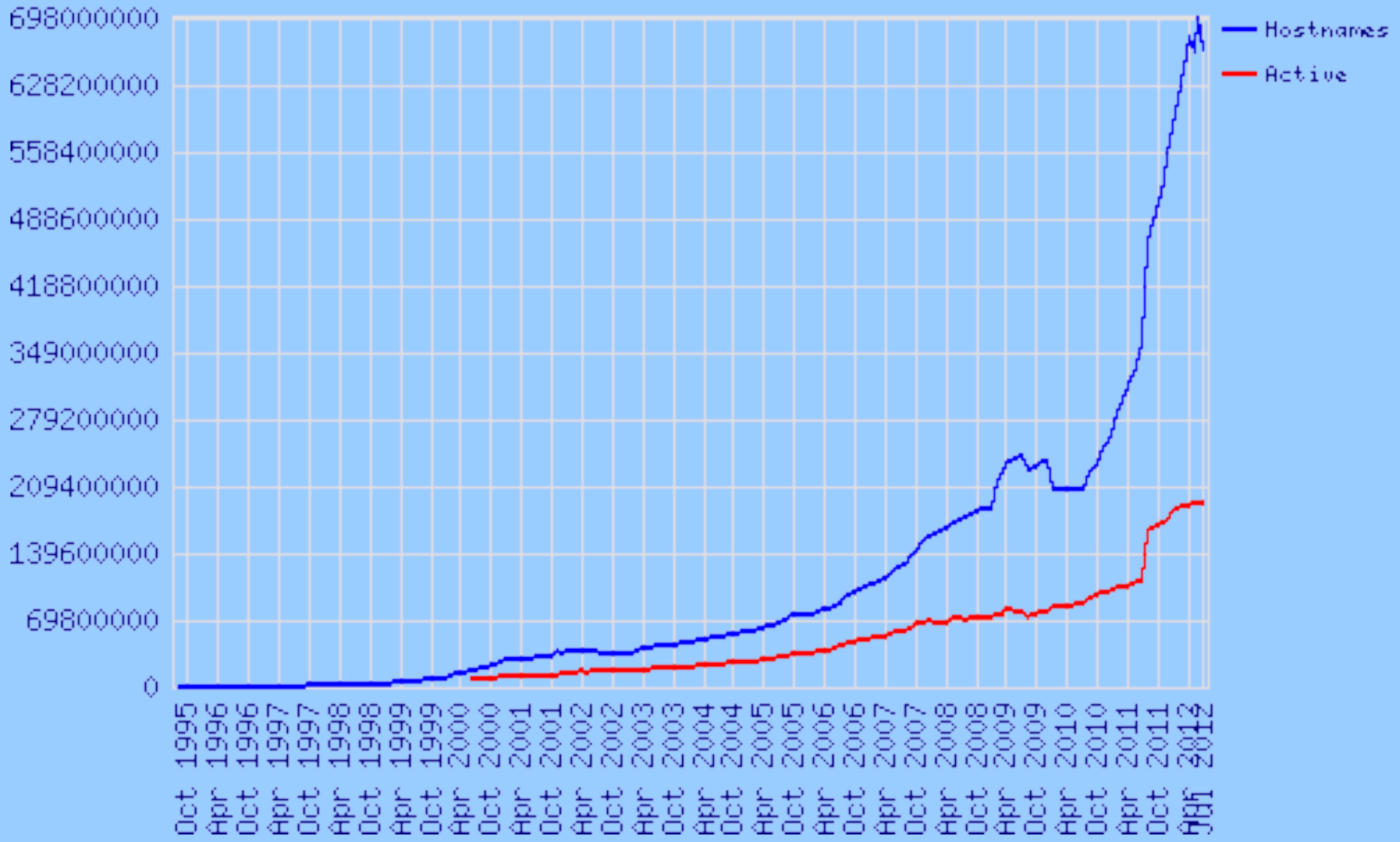
Browsers

- Initially just for the World Wide Web and just for textual information
- next generation handled graphics and now audio, video, animation and more...
- Also, browsers now provide access to electronic mail and newsgroups via a single piece of software in addition to Web access
- Live downloaded programs (e.g. Java Applets, ActiveX, Javascipt etc)

Finding Information

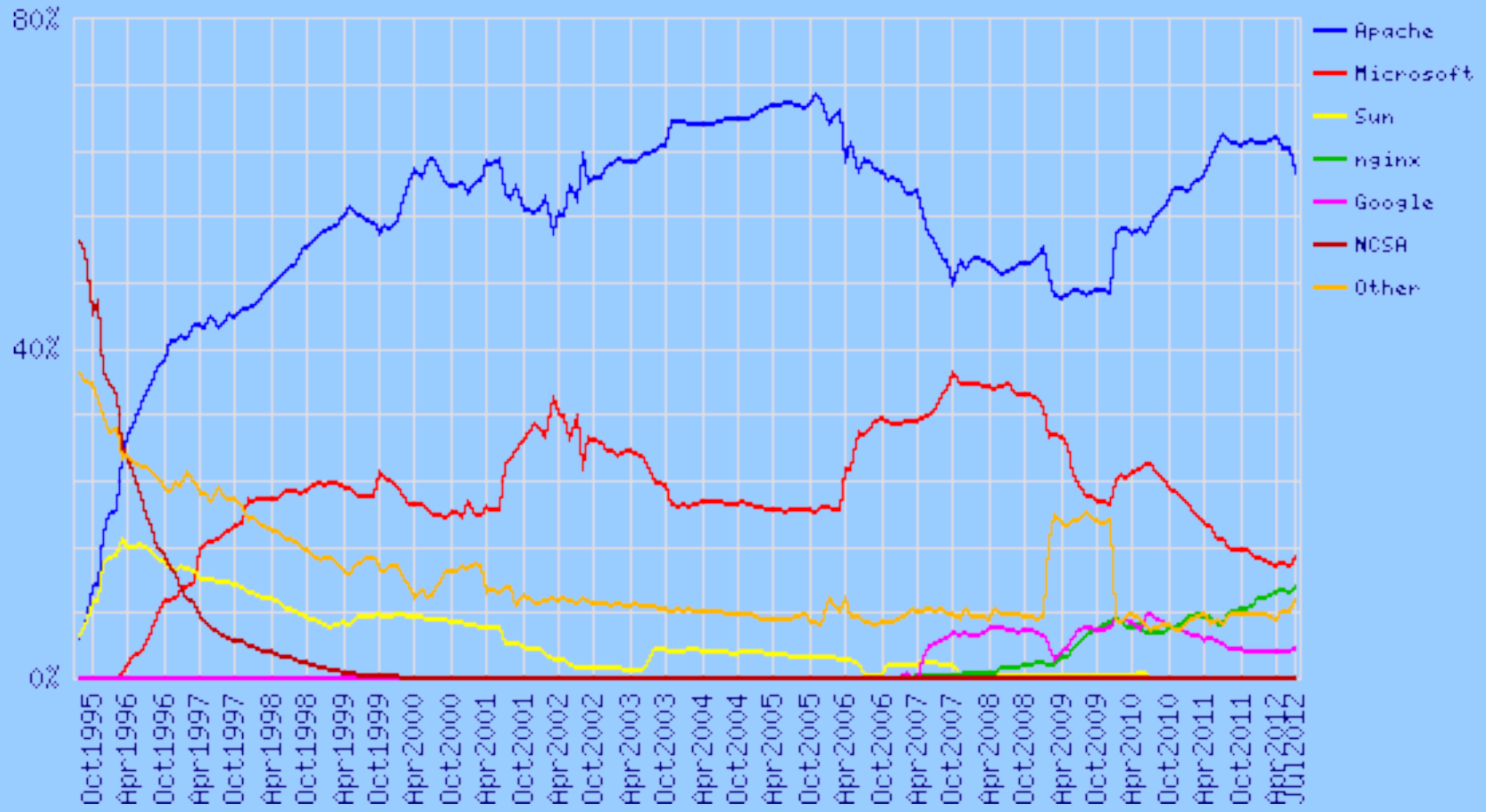
- one of the biggest problems that remains
- search engines (google, bing, ask, duckduckgo, …)
- directory services (www.yellowpages.com, www.yell.com, …)
- well known sites (bbc.co.uk/news, http://www.gardenersworld.com, sourceforge.net)

Total Web Sites Across All Domains August 1995 – July 2012



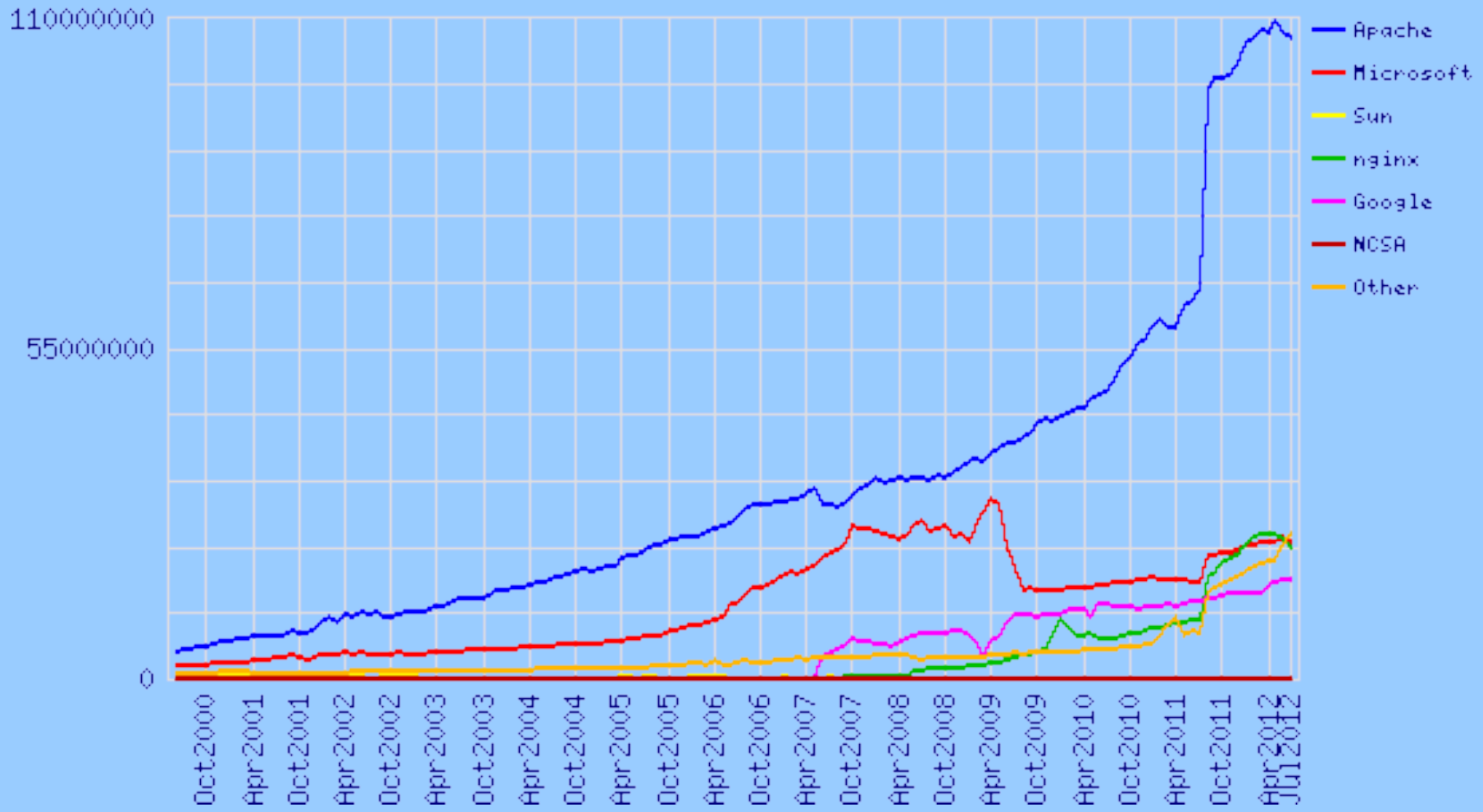
Source: Netcraft http://www.netcraft.com/

Products in use as World Wide Web Servers Aug 1995 -> July 2012



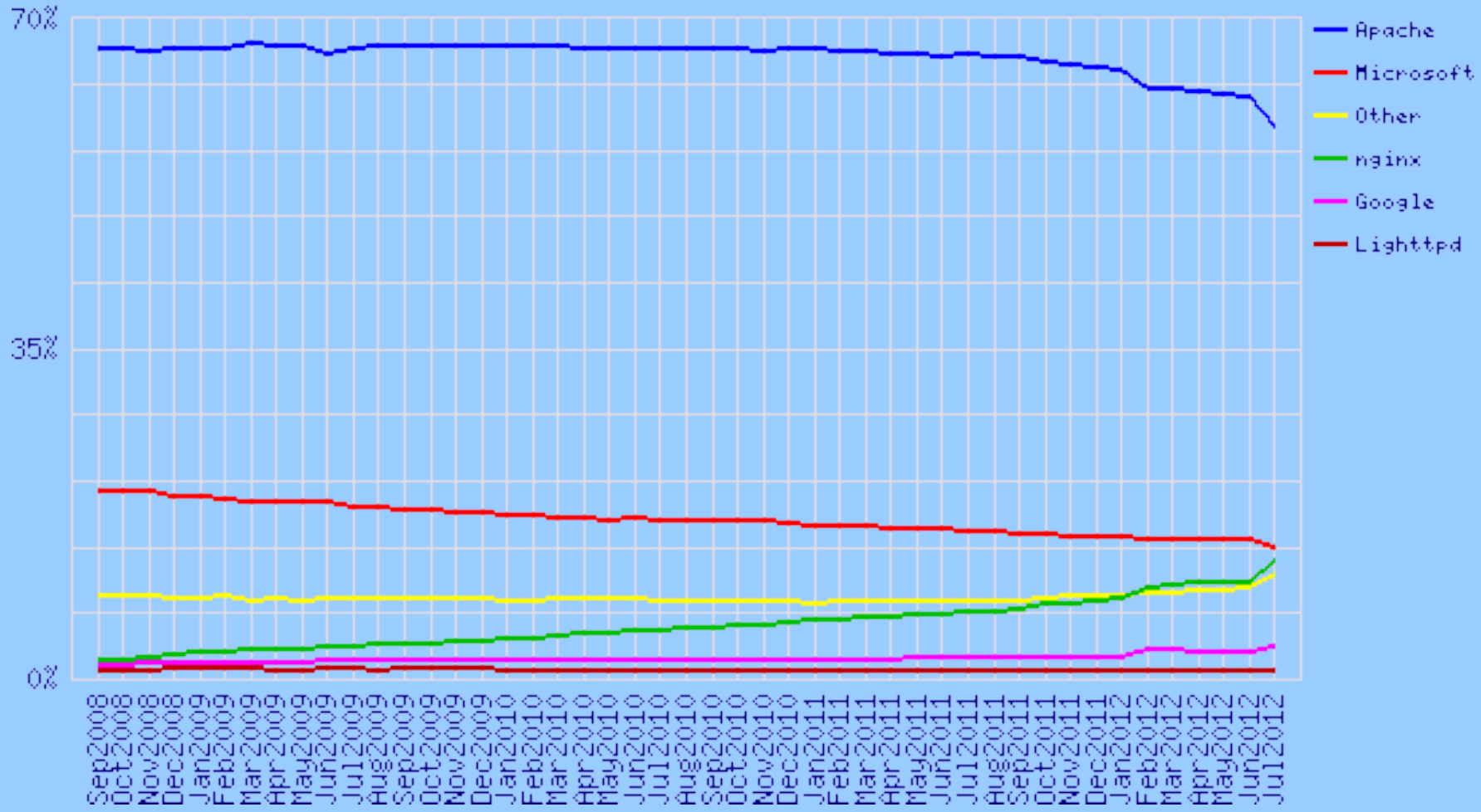
Source: Netcraft http://www.netcraft.com/

Totals for Active Sites Across All Domains
June 2000 - July 2012



Source: Netcraft http://www.netcraft.com/

Market Share for Top Servers Across the Million Busiest Sites
September 2008 - July 2012



Source: Netcraft http://www.netcraft.com/

Netcraft Statistics

- After July 2012 they change to “live” images that you can explore.
- http://news.netcraft.com/archives/category/web-server-survey/

Undersea Cables

- Undersea fibre cables really important
- Cable faults can cause major problems
- Asia telecoms await quake repairs (Jan 2007)
  - http://news.bbc.co.uk/1/hi/world/asia-pacific/6241299.stm
- Disruption after web cables cut (Jan 2008)
  - **http://news.bbc.co.uk/1/hi/business/7222411.stm**
- New cable cut compounds net woes (Feb 2008)
  - http://news.bbc.co.uk/1/hi/technology/7222536.stm
- Fiber-Optic Link Around the Globe – operated by
  - Global Cloud Xchange
- Submarine communications cable (Wikipedia)
  - http://en.wikipedia.org/wiki/Submarine_communications_cable
- List of international submarine communications cables (Wikipedia)
  - http://en.wikipedia.org/wiki/List_of_international_submarine_communications_cables

Internet for Business

- Locate their potential suppliers
- Allow customers to locate them
- General marketing and publicity
- Raise the profile of your area for Tourism
- Raise the profile of your area as a substantial shopping centre
- Buy and sell over the Net

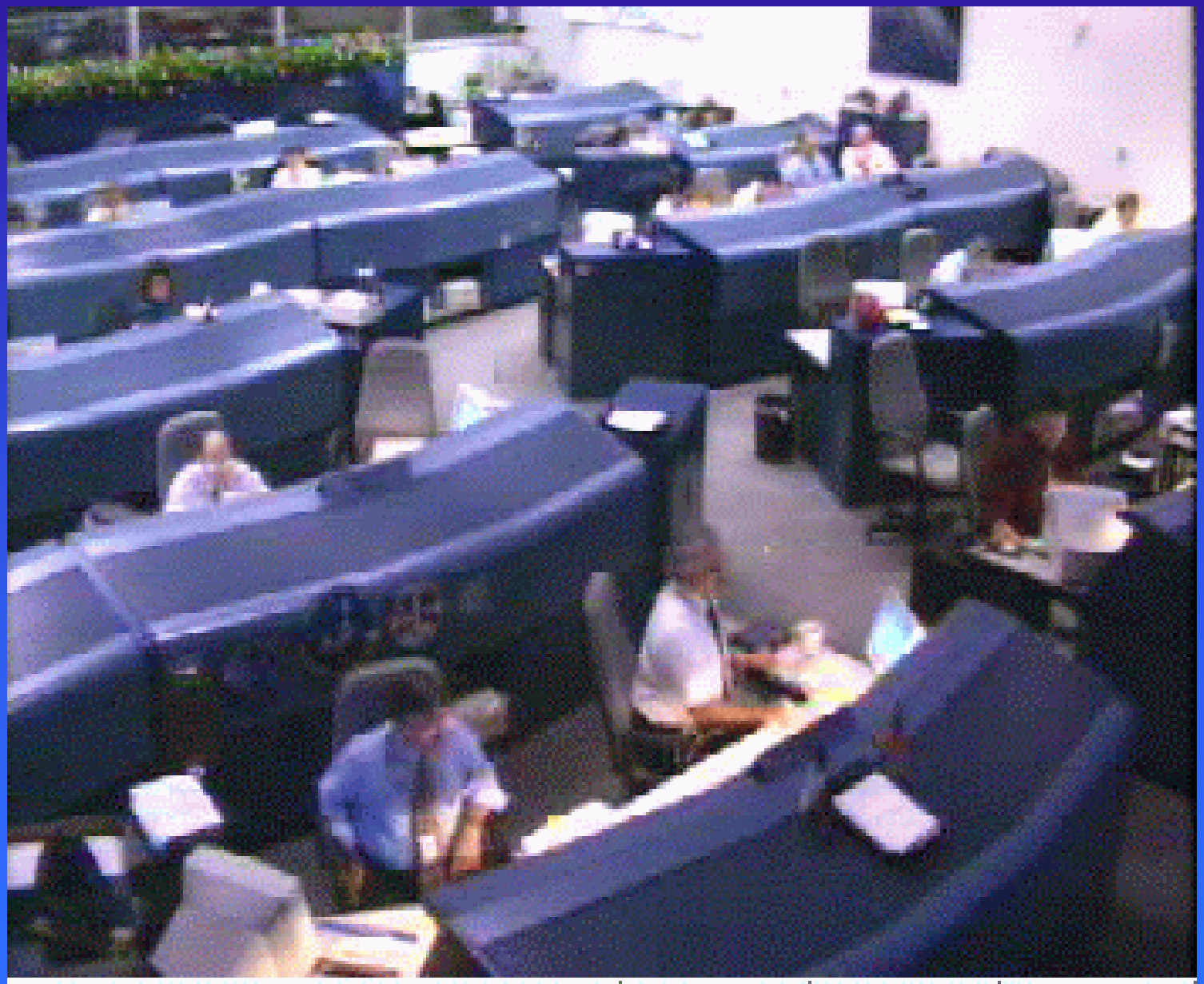
Electronic Trading and Security

- Now a well established reality
- At least four basic approaches
  - On-line credit/debit card transactions
  - Trusted third party (e.g. PayPal)
  - Direct bank account transfers
  - Electronic Wallet
- On-line banking now common
- All depends on secure transactions

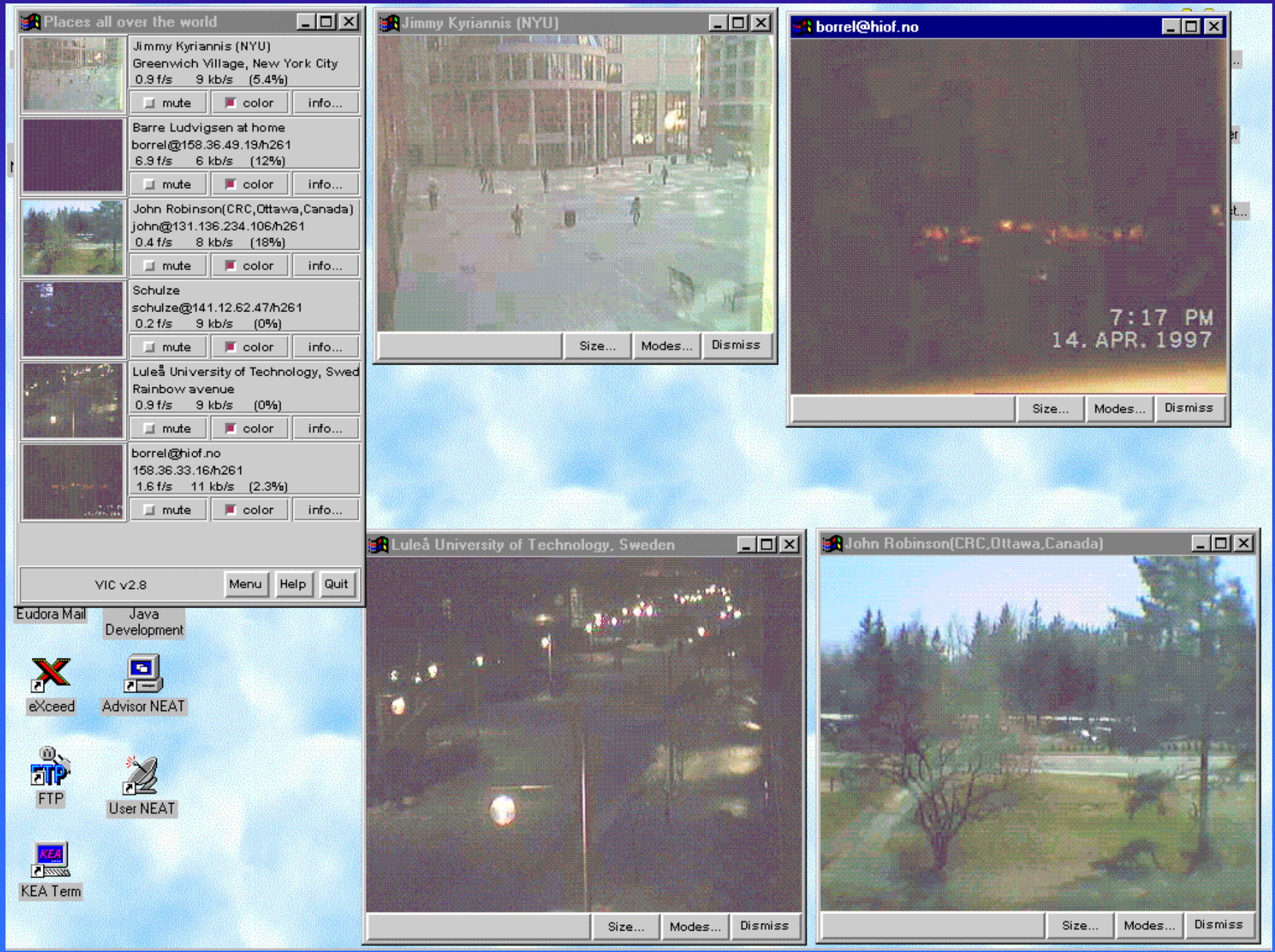
"More than just a web page" Applications

- On Demand Access to recorded audio and video
- Live Audio and Video - Rock Concerts and distant Conferences
- Severe Tire Damage
  - http://en.wikipedia.org/wiki/Severe_Tire_Damage_(band)
- Caduseus live at the Vortex
  - http://news.bbc.co.uk/1/hi/wales/mid/4932034.stm
  - http://www.aber.ac.uk/~dcswww/Telematics/MICE/vortex.html
- Interactive Desktop Conferencing with Video, Audio, WhiteBoards, Shared Editors and so on…..
- Now lots of multi-tier, distributed applications appearing

Early On Demand Video / Audio
"Real Media"

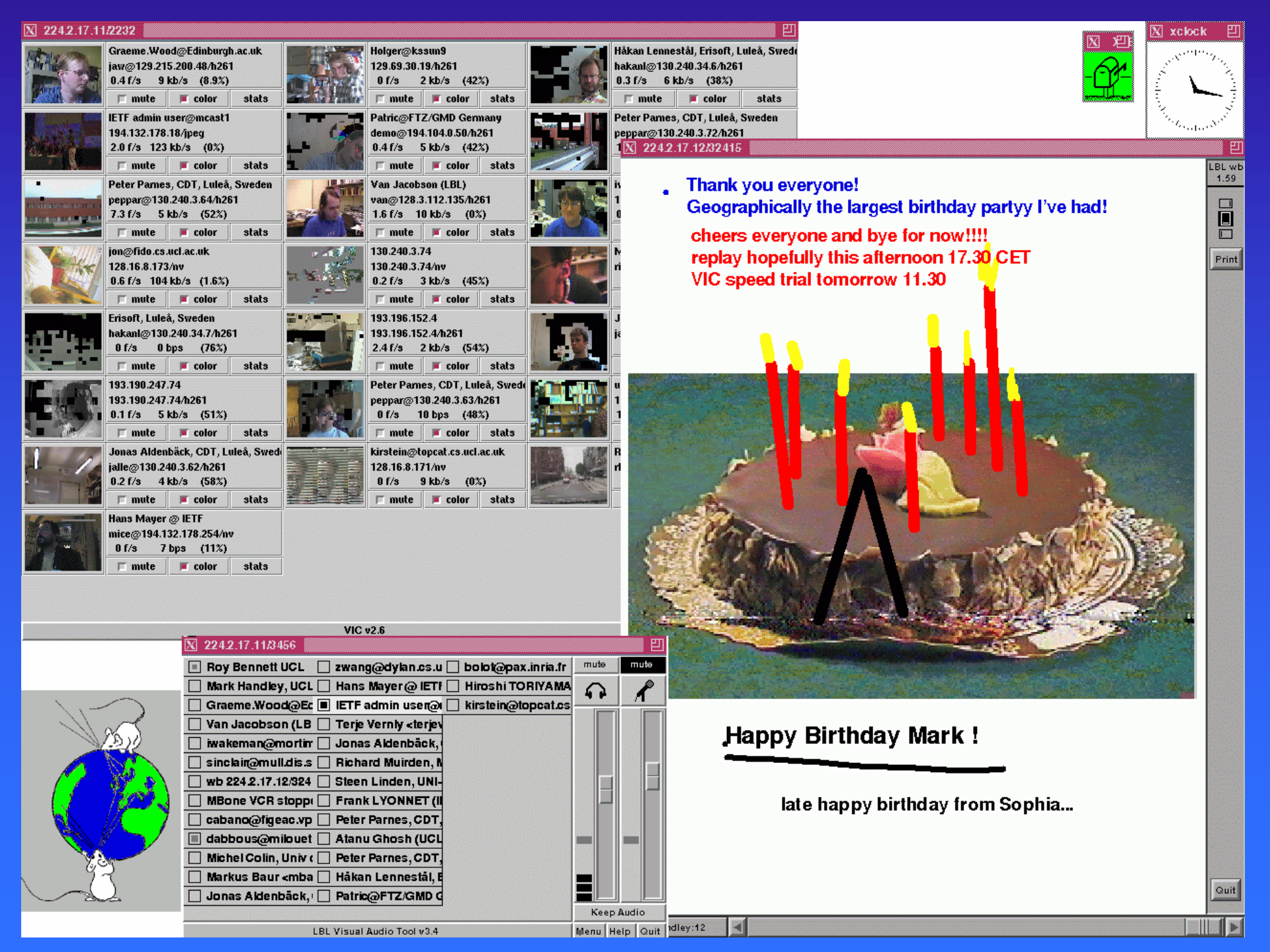


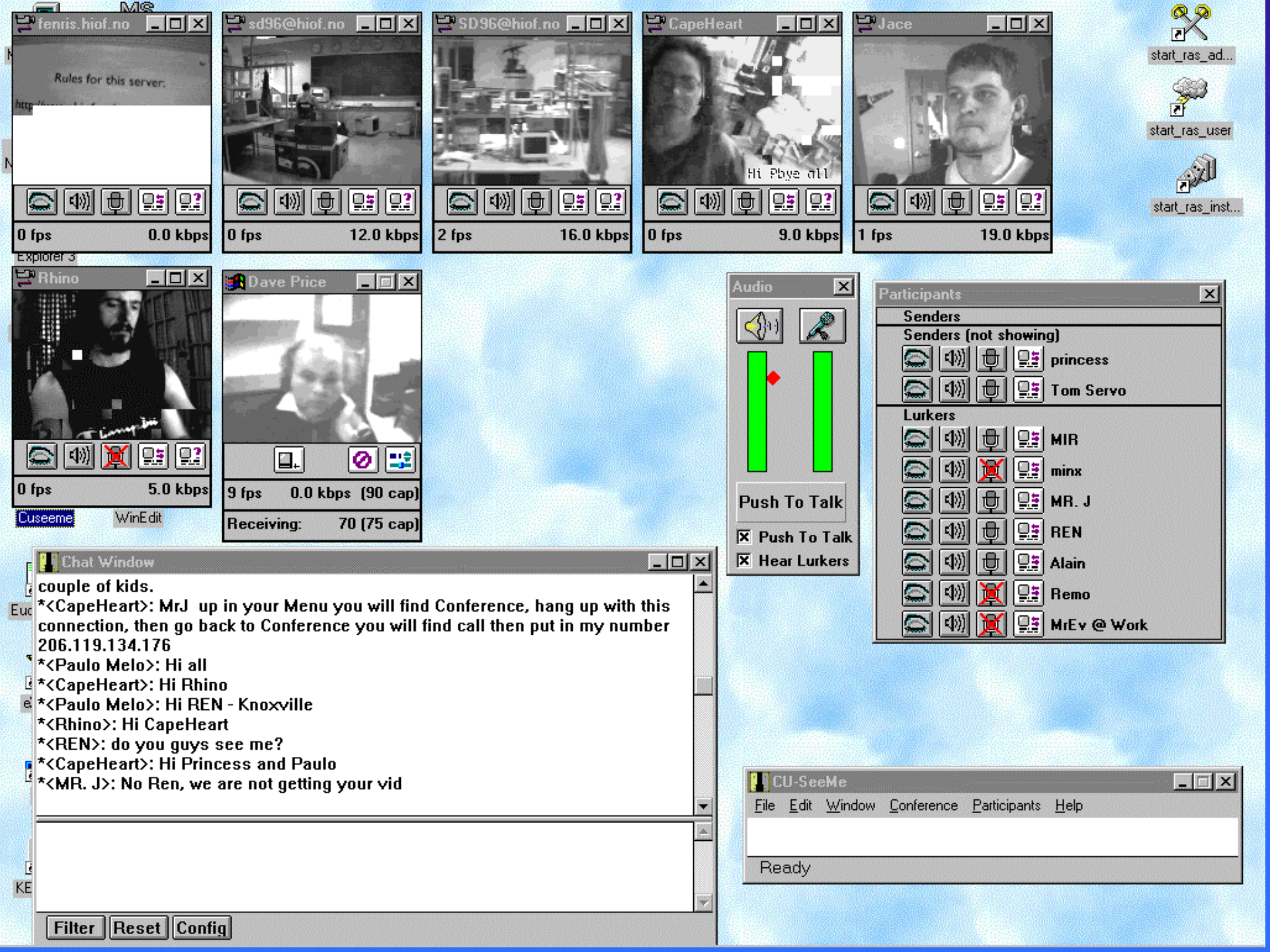
Size... Modes... Dismiss

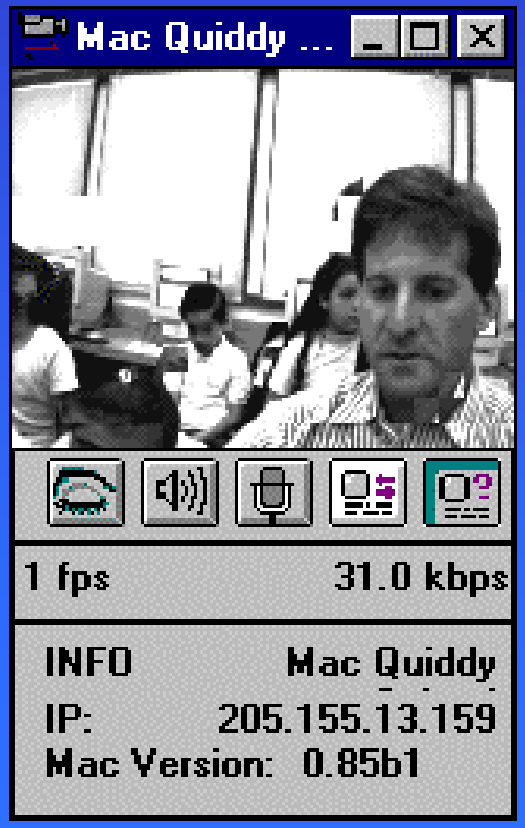

Places all over the world
Jimmy Kyriannis (NYU)
Greenwich Village, New York City
0.9 f/s 9 kb/s (5.4%)
mute color info...
Barre Ludvigsen at home
borrel@158.36.49.19/h261
6.9 f/s 6 kb/s (12%)
mute color info...
John Robinson(CRC,Ottawa,Canada)
john@131.136.234.106/h261
0.4 f/s 8 kb/s (18%)
mute color info...
Schulze
schulze@141.12.62.47/h261
0.2 f/s 9 kb/s (0%)
mute color info...
Luleå University of Technology, Swed
Rainbow avenue
0.9 f/s 9 kb/s (0%)
mute color info...
borrel@hiof.no
158.36.33.16/h261
1.6 f/s 11 kb/s (2.3%)
mute color info...
VIC v2.8
Menu Help Quit
Jimmy Kyriannis (NYU)
Size... Modes... Dismiss
borrel@hiof.no
7:17 PM
14. APR. 1997
Size... Modes... Dismiss
Luleå University of Technology, Sweden
Size... Modes... Dismiss
John Robinson(CRC,Ottawa,Canada)
Size... Modes... Dismiss
Eudora Mail
Java Development
eXceed
Advisor NEAT
FTP
User NEAT
KEA Term

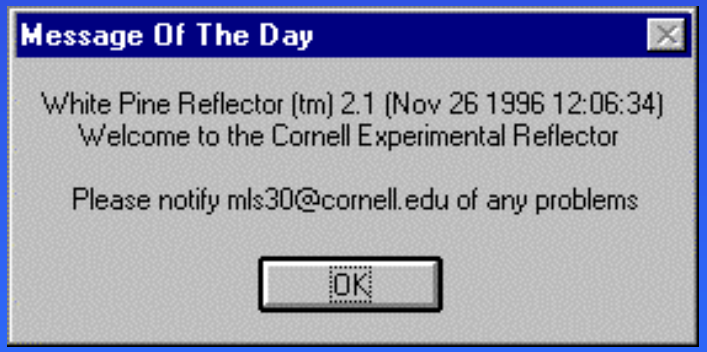
Interactive Conferencing

- “Interactive Desktop Conferencing with Video, Audio, WhiteBoards, Shared Editors and so on…..”
- Global Birthday Party
- Global Discussions
- “Mbone Tools”, “CuSeeMe”, “Skype”


224.2.17.11/2232
Graeme.Wood@Edinburgh.ac.uk
jaw@129.215.200.48/h261
0.4 f/s 9 kb/s (8.9%)
mute color stats
Holger@kssun9
129.69.30.19/h261
0 f/s 2 kb/s (42%)
mute color stats
Håkan Lennestål, Erisoft, Luleå, Swed
hakanl@130.240.34.6/h261
0.3 f/s 6 kb/s (38%)
mute color stats
IETF admin user@mcast1
194.132.178.18/jpeg
2.0 f/s 123 kb/s (0%)
mute color stats
Patric@FTZ/GMD Germany
demo@194.104.0.50/h261
0.4 f/s 5 kb/s (42%)
mute color stats
Peter Parnes, CDT, Luleå, Sweden
peppar@130.240.3.72/h261
mute color stats
Peter Parnes, CDT, Luleå, Sweden
peppar@130.240.3.64/h261
7.3 f/s 5 kb/s (52%)
mute color stats
Van Jacobson (LBL)
van@128.3.112.135/h261
1.6 f/s 10 kb/s (0%)
mute color stats
jon@fido.cs.ucl.ac.uk
128.16.8.173/nv
0.6 f/s 104 kb/s (1.6%)
mute color stats
130.240.3.74
130.240.3.74/nv
0.2 f/s 3 kb/s (45%)
mute color stats
Erisoft, Luleå, Sweden
hakanl@130.240.34.7/h261
0 f/s 0 bps (76%)
mute color stats
193.196.152.4
193.196.152.4/h261
2.4 f/s 2 kb/s (54%)
mute color stats
193.190.247.74
193.190.247.74/h261
0.1 f/s 5 kb/s (51%)
mute color stats
Peter Parnes, CDT, Luleå, Swed
peppar@130.240.3.63/h261
0 f/s 10 bps (48%)
mute color stats
Jonas Aldenbäck, CDT, Luleå, Swed
jalle@130.240.3.62/h261
0.2 f/s 4 kb/s (58%)
mute color stats
kirstein@topcat.cs.ucl.ac.uk
128.16.8.171/nv
0 f/s 9 kb/s (0%)
mute color stats
Hans Mayer @ IETF
mice@194.132.178.254/nv
0 f/s 7 bps (11%)
mute color stats
VIC v2.6
xclock
224.2.17.12/32415
LBL wb 1.59
Print
Thank you everyone!
Geographically the largest birthday partyy I've had!
cheers everyone and bye for now!!!!
replay hopefully this afternoon 17.30 CET
VIC speed trial tomorrow 11.30
Happy Birthday Mark !
late happy birthday from Sophia...
Quit
224.2.17.11/3456
Roy Bennett UCL
zwang@dylan.cs.u
bolot@pax.inria.fr
Mark Handley, UCL
Hans Mayer @ IETF
Hiroshi TORIYAMA
Graeme.Wood@Ed
IETF admin user@
kirstein@topcat.cs
Van Jacobson (LB
Terje Vernly <terjev
iwakeman@mortim
Jonas Aldenbäck,
sinclair@mull.dis.s
Richard Muirden, M
wb 224.2.17.12/324
Steen Linden, UNI-
MBone VCR stopp
Frank LYONNET (I
cabano@figeac.vp
Peter Parnes, CDT,
dabbous@mirouet
Atanu Ghosh (UCL
Michel Colin, Univ
Peter Parnes, CDT,
Markus Baur <mba
Håkan Lennestål, E
Jonas Aldenbäck,
Patric@FTZ/GMD G
mute
mute
Keep Audio
Menu Help Quit
LBL Visual Audio Tool v3.4
ndley:12


fenris.hiof.no
Rules for this server:
0 fps 0.0 kbps
sd96@hiof.no
0 fps 12.0 kbps
SD96@hiof.no
2 fps 16.0 kbps
CapeHeart
Hi Phye all
0 fps 9.0 kbps
Jace
1 fps 19.0 kbps
start_ras_ad...
start_ras_user
start_ras_inst...
Explorer 3
Rhino
0 fps 5.0 kbps
Cuseeme
WinEdit
Dave Price
9 fps 0.0 kbps (90 cap)
Receiving: 70 (75 cap)
Audio
Push To Talk
Push To Talk
Hear Lurkers
Participants
Senders
Senders (not showing)
princess
Tom Servo
Lurkers
MIR
minx
MR. J
REN
Alain
Remo
MrEv @ Work
Chat Window
couple of kids.
*<CapeHeart>: MrJ up in your Menu you will find Conference, hang up with this connection, then go back to Conference you will find call then put in my number 206.119.134.176
*<Paulo Melo>: Hi all
*<CapeHeart>: Hi Rhino
*<Paulo Melo>: Hi REN - Knoxville
*<Rhino>: Hi CapeHeart
*<REN>: do you guys see me?
*<CapeHeart>: Hi Princess and Paulo
*<MR. J>: No Ren, we are not getting your vid
Filter
Reset
Config
CU-SeeMe
File Edit Window Conference Participants Help
Ready





Cornell Experimental Reflector 14th April 1997

Internet TV
"Westminster Select Committee Thursday 19th March 1998".

John Birt (BBC Boss) says…

"We are not far off the Internet emerging as an on-demand television service"

February 2006

BBC launch Multicast Trial Access to TV channels

http://www.bbc.co.uk/multicast/

2016

BBC3 TV Channel Goes on-line only.

Social Media / Social Profiles

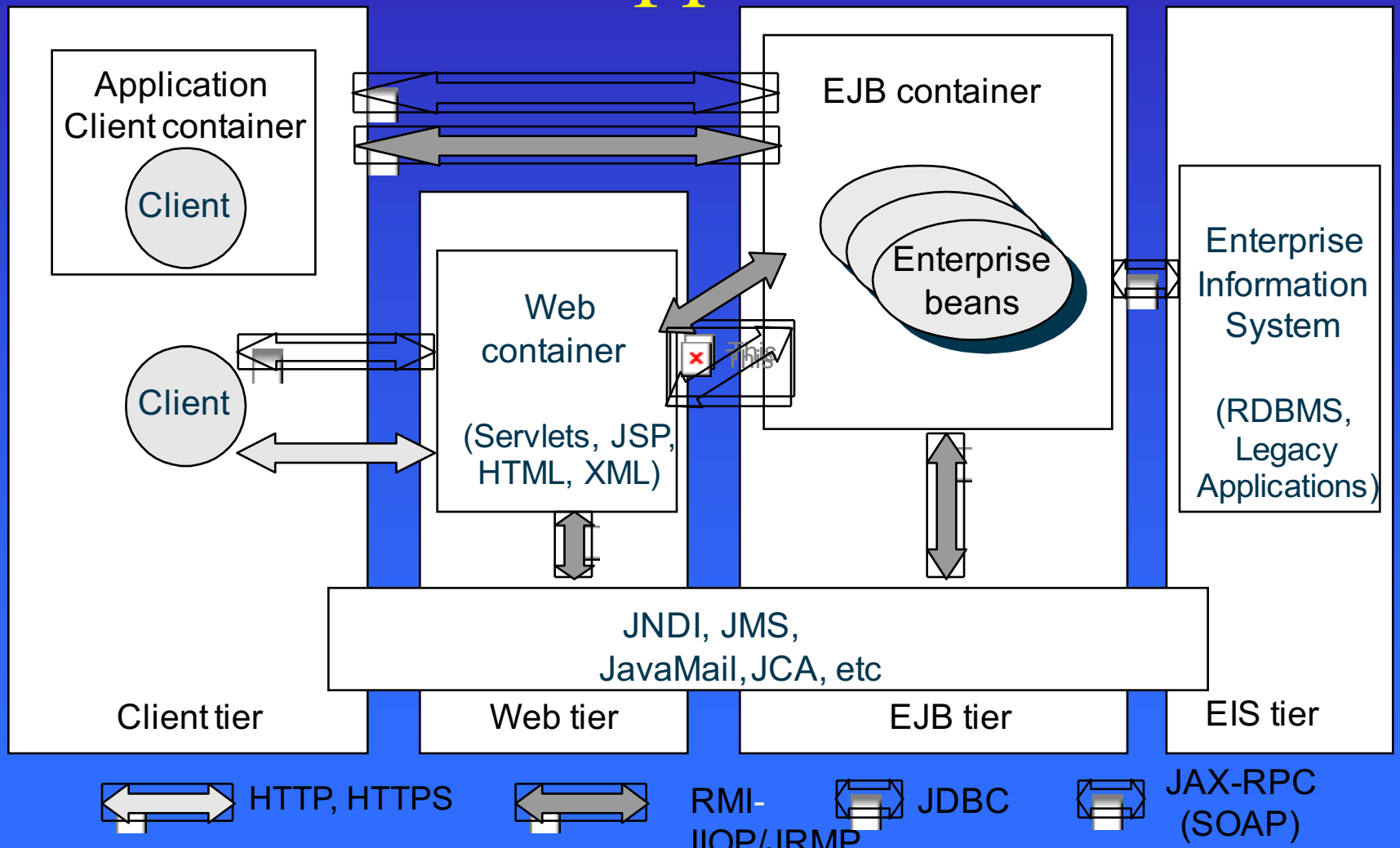
Twitter – short messages only "tweets" (120 chars)
Facebook – timelines (was "walls"), pages, groups
LinkedIn – academic/business profiles,"connections"
Pinterest – image based "interests pinned on boards"
Tumblr – "micro blogging platform"
Flickr – images and photographs
Instagram – mostly photo and short video sharing

…

Auto-tweeting …..

www.buffer.com - prepare tweets/posts in advance

Cloud Computing / Services

- Internet based storage
  - Dropbox
  - Google Drive / Googles Doc
  - Microsoft Skydrive – Now OneDrive –TWO different products!
- Internet based computation
  - Beowulf Clusters
  - Google's Compute Engine
  - Amazon Elastic Compute Cloud (Amazon EC2)
- Internet located email
  - Hotmail
  - Outlook 365
- Internet based "Office" products
  - Microsoft's Office 365's "Office on the Cloud"

J2EE Environment: Multi-tier support